Mask Shadowing and the Line-edge Transfer Function

Brittany McClinton, University of California Berkeley

Owing to the mask-side non-telecentricity resulting from the reflective nature of extreme ultraviolet lithography (EUVL), mask shadowing is well-known to be an issue for EUVL. The shadowing problem is also expected to become more severe as numerical apertures are increased in the future and even larger mask illumination angles become required. Although the shadowing problem in general has been well studied, the impact this effect might have on the transfer of line-edge roughness (LER) from the mask to the wafer has not been studied. Here we extend previous efforts in the analysis of the LER transfer function (LTF) to explicitly include 3D mask effects. We show that the LTF differs for the shadowed and non-shadowed directions: moreover, the LTF of the left-side edge differs from the right-side edge in the shadowed direction. Finally, we also observe a breakdown of the linearity of the LTF for shadowed features.

This work was supported by the Director, Office of Science, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.